ANNOTATION
for dissertation work of the PhD Student in 6D071900 «Radio engineering, electronics and telecommunications»
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On a theme «The analysis and model operation of effectiveness of the developed telecommunication networks on the basis of programmatic IP-PBX Asterisk»

Actuality of theme. Presently IP - PBX Asterisk the most widespread program and her stake make 85% "market" of opensource PBX, that it is constrained with a lot of interest to services of programmatic IP - PBX

In process as a basic decision development of services of IP- of telephony is carried out in an university with organization of off-wire connection two LAN with the use of programmatic Asteriskco by the specialized distributive of Elastix on the base of OC CentOS

Elastix – the free universal server of communications on the basis of Centos which unites in itself digital automatic telephone exchange on the basis of Asterisk, the IM e-mail server, the HylaFax fax server and tools for collaboration – the calendar integrated with automatic telephone exchange for automatic voice notices, the telephone directory, two CRM integrated into the interface: vTigerCRM both SugarCRM, and the DHCP server for automatic configuration of VoIP-phones. At the same time modules of call center, autocall-down, record of a talk, statistics became available. Thus, all most demanded opportunities which the automatic telephone exchange presented at the university for conducting testing (calls, the attacks, etc.), uses for exchange of calls and training of students in obtaining practical skills not only in communication, but also possession of skills of configuration of OC Linux.

This dissertation work is devoted not only to a research of the traffic received on the basis of operational analysis of network (stand) constructed at the university but also to creation of program animation of packetization of voice counting and also a research and model operation of program automatic telephone exchange on the basis of IP-PBX Asterisk in creation of network of telecommunications with the analysis of effectiveness of its functioning that are a relevant task at projection and operation of telecommunication networks. At the same time interaction of two IP-PBX Asterisk was carried out as the wire decision. At projection of telecommunication network of any complexity for ensuring high degree of reliability and survivability, decrease in capital investments with important tasks are working off of different situations of functioning of network and its clusters in use, studying of behavior of network at input of new mechanisms and expansions of a range of the provided services.

Thus, application of IP-PBX in network of telecommunication is relevant in the sphere of the organization of corporate communication on the basis of innovative solutions. Accounting of all requirements imposed to networks is necessary for high-quality projection of local computer networks on the basis of program automatic telephone exchanges of AsteriskNow. The solution of a task by

means of a simulation modeling of networks is also relevant that allows to plan, define possible future problems of operation and development in advance, to test a regularity and possibilities of operation of the network equipment for different situations of functioning, to carry out studying of new technologies and mechanisms, and the most important thanks to means of a simulation modeling occurs the considerable economy of tools.

Object of research is functioning of two LAN organized on the basis of programmatic AsteriskNow.

Article of research are imitating models of the developed network, a research of the measured actual voice traffic in the developed network, measures on the protection of this network against the malicious attacks allowing to improve indicators of QoS, model in software packages of NetCracker and OPNETModeler with identification of coefficient of utilization, a channel capacity at receipt of various entering loading.

Purpose of dissertation work is increase in effectiveness and stability of functioning of data transmission networks and the IP-telephonies systems on the basis of carrying out an expanded simulation modeling of work of two LAN organized on the basis of the AsteriskNow platform in the form of the separate terminals divided among themselves by a particular distance with use of a package of the NetCracker 4.1 and OPNETModeler application programs.

For achievement of a goal in the thesis the following problems sequentially are solved:

- development of the scheme of the organization of wireless network on the basis of AsteriskNow with use of the microstrip antenna;

- to conduct a research of the measured actual voice traffic;

- to carry out a simulation modeling of the created network on the basis of the software package of NetCracker with identification of coefficient of utilization;

- to develop schemes of knot of the intended attack to the client-server developed network, to analyse and develop offers on taking a step on protection of this network;

-to carry out a simulation modeling of the created network in an envelope of OPNETModelerv.14 with studying of a channel capacity of network;

- to carry out a simulation modeling of the created network in an envelope of OPNETModelerv.14 with various entering loading;

- to create program realization of packetization of voice reports at digitization.

Research techniques. Achievement of objectives were made with use of probability theory and mathematical statistics, systems analysis, numerical methods of applied mathematics, mathematical and physical model operation, computing, physical experiments, methods of a rational design of experiments, a simulation modeling and animation model operation.

The idea of work consists in creation of adequate imitating model of local network on the basis of IP-PBXAsteriskNow, allowing to investigate process of data transmission and work of program automatic telephone exchanges in various modes for definition of the most reliable system of information security from the

external attacks and threats of information security.

Scientific novelty:

- schemes of the organization of wireless network are developed and the actual network at the university and in corporation of the railroad on the basis of AsteriskNow with the IntelXeon operating system under LinuxCentOS 4 with use of the developed microstrip antenna;

- on the basis of experiments and statistical tests decrease of an error of work of MPI is carried out twice that led to decrease of marriage by 156 times;

- the research of the measured actual voice traffic probability and time characteristics showed at exchange of local networks on air course of the simplest stream. Assessment on a normality on a goodness-of-fit test of Kolmogorov-Smirnov (the D statistics) showed that the critical value of criterion (Dmax) at a sample size of a number of distribution of intervals between calls equal to value 60 is 0,1753 for value p =0,05 and 0,2101 for value p =0,01 and as Dexp=0,16291 less Dk=0,2101, a hypothesis that empirical distribution is accepted normal. Assessment on a normality by Shapiro-Uilka's criterion showed that an empirical row is distributed under the normal law. At the received W=0,90042 values; p=0,00014 turns out that the null hypothesis means that distribution normal, that it will be accepted under a condition, if the level of a statistical significance of p is p>0,05 and at high values W (W>0,9). The alternate hypothesis is rejected. Assessment $\chi2$ showed that intervals between calls are distributed under the exponential law. For our research a degree of freedom of K=59, at significance levels p =0,05 and p =0,01 critical values are respectively equal to 67,5 and 76,2. The experimental value of all is equal to 6,36349. Therefore, the studied row has an exponential distribution as critical values several times there are more experimental datas;

- showed monitoring and the analysis of network packages in the CommView for WiFi program that the held series of attacks from the laptop on the developed network in the course of the videoconference session is carried out by this program the analysis of the entrapped network packages broadcast and MAS addresses of computers of participants of a videoconference, the number of the packages created at the same time, ways of enciphering, various statistics of network traffic are revealed (for example, counting about the received and sent shots to the relevant mac-address)

- the developed imitating models of the developed network in the OPNETModeler v.14 program allowed to obtain statistical data of the analysis of traffic and graphics of transfer rate of data between components of network. At the same time it is visible that in general the developed network works steadily poorly utilized packages, the required effectiveness still is in a state, the allowing carrying out expansion of network, the functional communications between components of the developed network are also shown;

-the developed imitating models of the developed wireless network of two local computer networks showed in the NetCracker 4.1 program that the most large number of the utilized packages turns out after the router. It is bound to the fact that the router does not manage to process all packages, besides those packages

which have not the corresponding addresses of appointment on this network are thrown out after check by the router. The biggest percent of the utilized packages turns out when distribution of traffic under the law of the Erlang, that is when packages arise under the law of the Erlang is set and between packages time is also distributed on the Erlang. As for the packages distributed under the law Uniform – the number of the utilized packages are slightly less, and smalls of the utilized traffic it turns out under the exponential law, as confirms that really in the developed network the simplest stream proceeds;

– A program was developed in C++ for visualization of process of packetization of voice measurements.

Practical significance:

- the conclusions received in the thesis about advantages of local networks on the IP-PBX Asterisk platform demonstrate expediency and the prospects of their application in the modern transmitting systems of data (for the developed conditions in the Republic of Kazakhstan);

- results of the conducted theoretical and pilot researches of local networks on the IP-PBXAsterisk platform gave the considerable economic effect that is confirmed with the relevant acts of introduction of results of dissertation work.

The original scientific positions submitted for protection:

-imitating models of the created network on the basis of the software package of NetCracker with identification of coefficient of utilization;

-imitating models of network functioning for the organization of highly protected local corporate networks of information transfer and providing various service modes and options for IP-telephony;

- the developed scheme of the malicious attack to client-server network with measures for protection of network;

-imitating models in an envelope of OPNETModeler v.14 with the analysis of a channel capacity of network at receipt of various entering loading;

- packetization animation.

Personal contribution of the doctoral candidate. All results presented in dissertation work and having scientific novelty are received by the author personally and under the leadership of the research supervisor.

In work as Yakubova M.Z. environments belong statements of tasks on model operation in the program NetCracker and OPNETModelerv.14.

Approbation of results of a research. Results of theoretical and pilot studies are realized in technology functioning of two LAN. Work of this installation happens on the basis of the open program server of telephony AsteriskNow. For carrying out experiments are used simulation modeling on the basis of the software package of NetCrasker 4.1. Now the model is in KSTU at department TCS.

The main results of researches were reported and discussed at the International scientific and practical "IFOST-2016" conference (Novosibirsk, Russia); International scientific and practical conference "EDM-2016" (Novosibirsk, Russia); International scientific and practical conference "World Science" Dubai, UAE (2016); In news of National Academy of Sciences of the

Republic of Kazakhstan series of geology and technical science (Almaty, 2017).

Publications on a thesis. By results of work 12 publications on a thesis are published, including 7 – in the scientific publications recommended by committee on monitoring in education and the Ministry of Education and Science of the Republic of Kazakhstan, from them 2 certificates on intellectual property, 4 - in the magazine entering into Scopus base, 4 - in the magazine entering into Thomson Reuters base, 4 - in materials of conferences, including 3 foreign.

Structure and volume of work. The dissertation consists of introduction, four chapters, the conclusion, the list of references from 110 names and applications. The main part is explained on 109 pages of the typewritten text. Work contains 90 drawings, 10 tables, 2 applications.

Articles in international peer reviewed scientific journals :
- Mubarak Yakubova1, Tansaule Serikov. Development and Imitating Modeling in the Developed Network Consisting of Several Knots Removed Among Themselves on Netcracker 4.1. – INT -ERNATIONAL CONFERENCE ON MICRO/NANOTECHNOLOGIES AND ELECTRON DEVICES EDM 2016y. №17. – 210-213p.

-Yakubova M.Z.,Serikov T.G., Muratova A.K. Protection of IP-telefony networks on the basis of Asterisk from interception of data – Известия Национальной академии наук Республики Казахстан, 2017, №421. – 149-156c.

-Yakubova M.Z., Serikov T.G.,Mekhtiev A.D., Muratova A.K., et al. The Analysis and Modeling of efficiency of developed Telecommunication networks on the basis of IP PBX Asterisk NOW-11-th International Forum on Strategic Technology. June 1-3, 2016, Novosibirsk,Russia -510-515p.

Articles in publications recommended by the Committee for Control Education and the Ministry of Education and Science of the Republic of Kazakhstan :
- Якубова М.З., Сериков Т.Г., Задорожнюк М.Е. Расчет требуемой пропускной способности каналов и запаса на расширение сетей Ethernet // Труды университета, – Караганда, 27.09.-27.06.2016. – № 3(64) – С108-110.

- Якубова М.З., Разинкин В.П., Сериков Т.Г., Муратова А.К. Research of production errors' influence on characteristics of the microstrip antenna. – Вестник Карагандинского университета. Серия «Физика». – 2016 № 4(84). – 31-36c.

- ЯкубоваМ.З., СериковТ.Г. IP PBX Asterisk NOW telecommunication network and choice of tools for carrying out attacks. Development and research of the attack scheme to the developed client–server network on the basis of Wi-Fi // Вестник Карагандинского университета. Серия «Физика» – 2016, №2 (82).

- Якубова М.З., Сериков Т.Г. IP-PBX ASTERISKNOW негізінде әзірленген телекоммуникация желілерінің тиімділігін талдау және модельдеу – Вестник ПГУ 2017, №1. – 280-288c.

- Якубова М.З., Сериков Т.Г. Asterisk қорында IP-телефония желілерін деректерді ұстап қалудан қорғау – Вестник ПГУ 2017, №1. – 288-296с.

- Якубова М.З., Разинкин В.П., Сериков Т.Г., Муратова А.К. Protection of IP-telefony networks on the basis of Asterisk from interception of data. – Вестник Карагандинского университета. Серия «Физика». – 2016 № 4(84). – 24-30с.

International scientific practical conferences:

- Mubarak Yakubova1, Tansaule Serikov. Development and Imitating Modeling in the Developed Network Consisting of Several Knots Removed Among Themselves on Netcracker 4.1. – INTERNATIONAL CONFERENCE ON MICRO/NANOTECHNOLOGIES AND ELECTRON DEVICES EDM 2016у. №17. – 210-213р.

- СериковТ. Г.,ЯкубоваМ. З. The comparative analysis of architecture of Asterisk in relation with classical automatic telephone exchanges. – International Scientific and Practical Conference «WORLD SCIENCE», № 4(8), Vol.1, April 2016г.
- Якубова М.З., Сериков Т.Г., Esernet Желілерін кеңейту үшін каналдардың қажетті өткізгіштік қабілетін және қорын есептеу - ҚарМТУ "Ғылым, білім және өндіріс интеграциясы – Ұлт жоспарын іске асырудың негізі" (№9 Сағынов оқулығы) Халықаралық ғылыми – практикалық конференциясының еңбектері. 22-23 маусым 2017ж № 2 Бөлім. Б.255-257.